

Integrated Factory Designs Using Modeling and Simulation

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Outline of Presentation

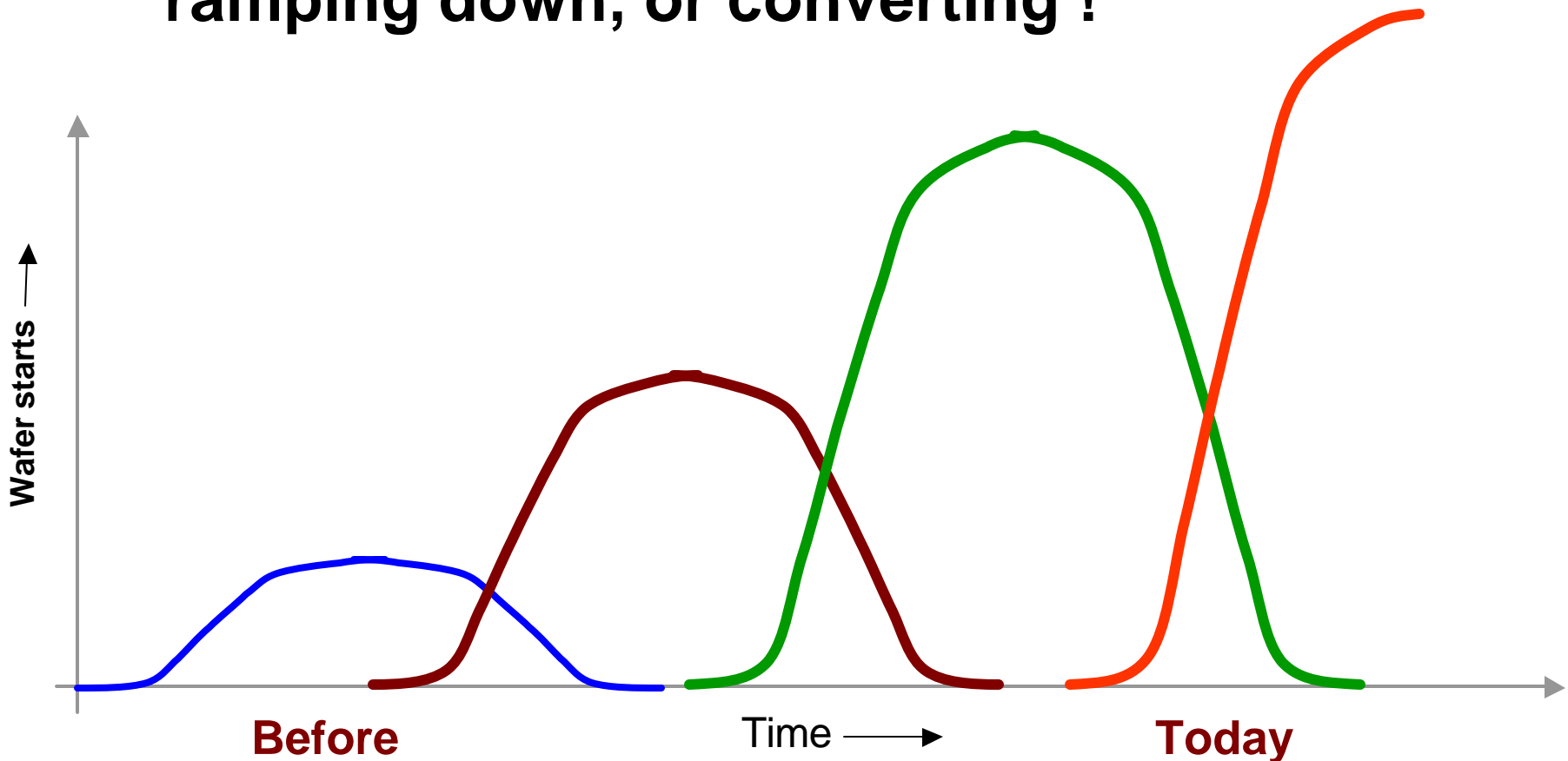
- **Current business/factory environment**
- **Factory Integration challenges in new factories**
 - ◆ **Key questions needing answers**
- **Simulation & Modeling methodology**
- **What is working/needs improvement in simulation**
- **Paradigm changes needed**
- **Conclusion**
- **Q&A**

Volatile market conditions are driving new factory attributes

- **Simultaneous introduction of multiple products**
- **Very short product and equipment lifetimes**
- **Frequent changes to equipment, layouts, and operations**
- **Wafer size change from 200mm to 300mm**
- **Overall, a very dynamic factory environment**

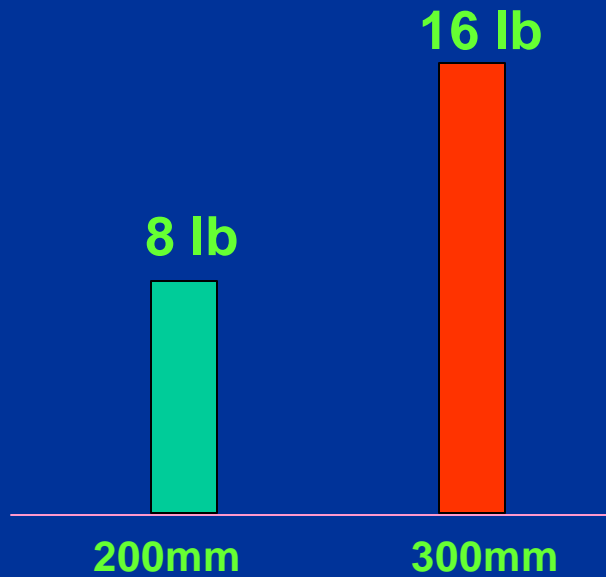
Today's factory has no steady state!

- Modeling implication - the factory is always either ramping up, ramping down, or converting !



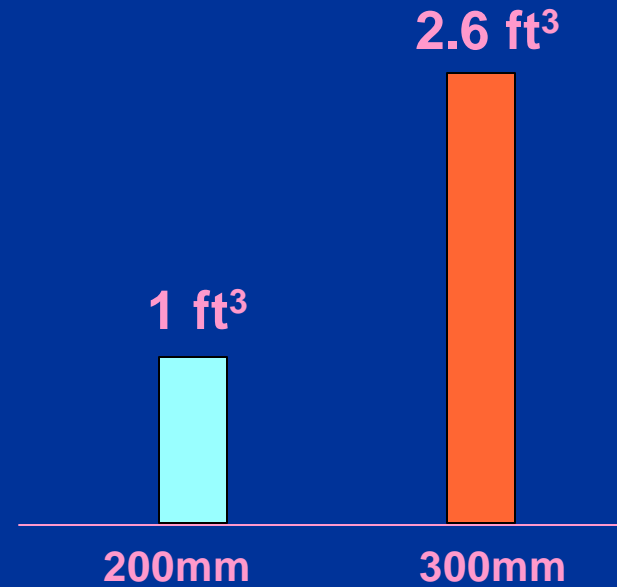
300mm Factory - Why it's different

Carrier Weight



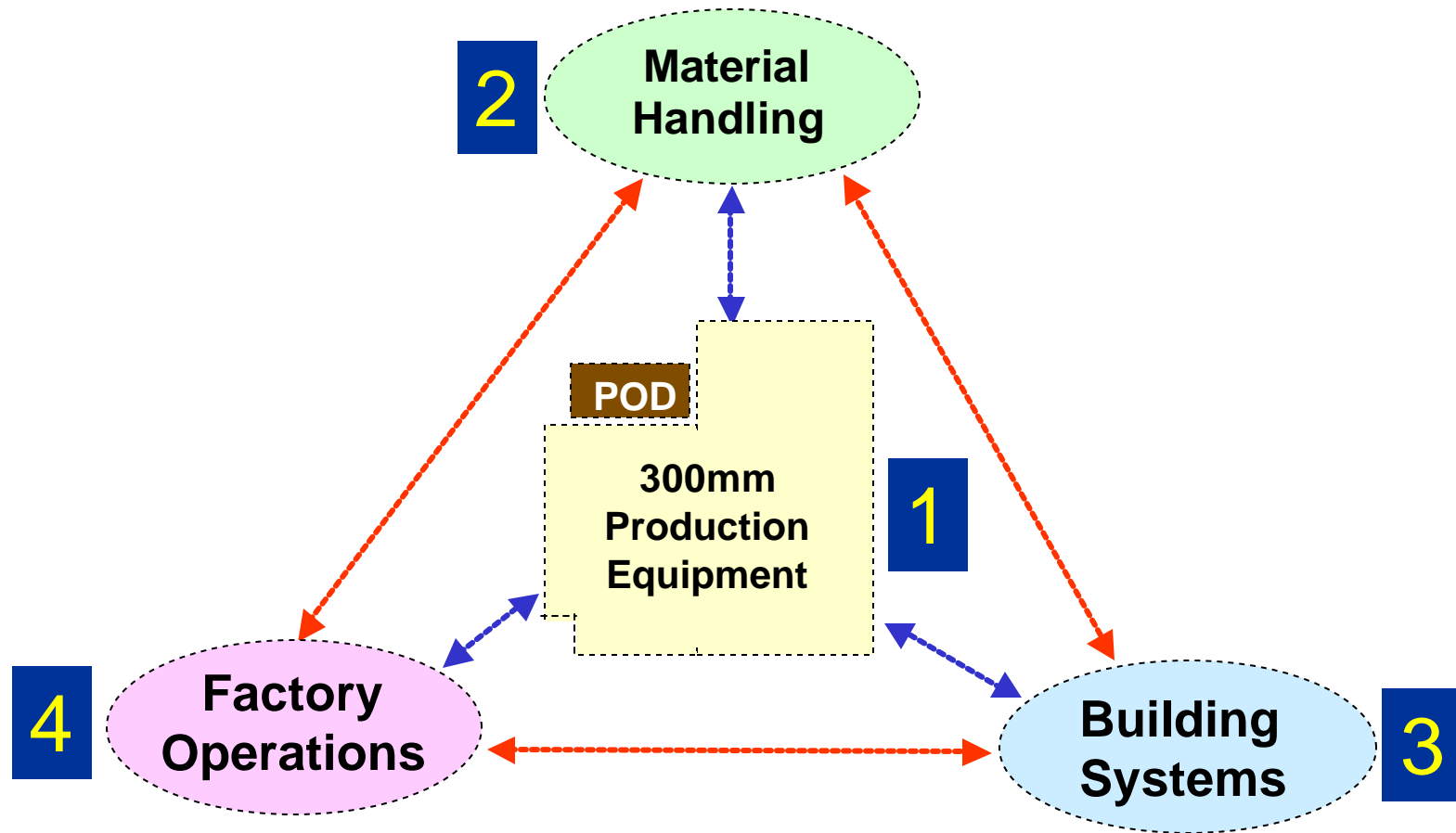
+

Carrier Volume (Size)



These significant changes will completely alter and change the way we plan, organize, layout, install, staff, and operate the 300mm factory

Factory Integration

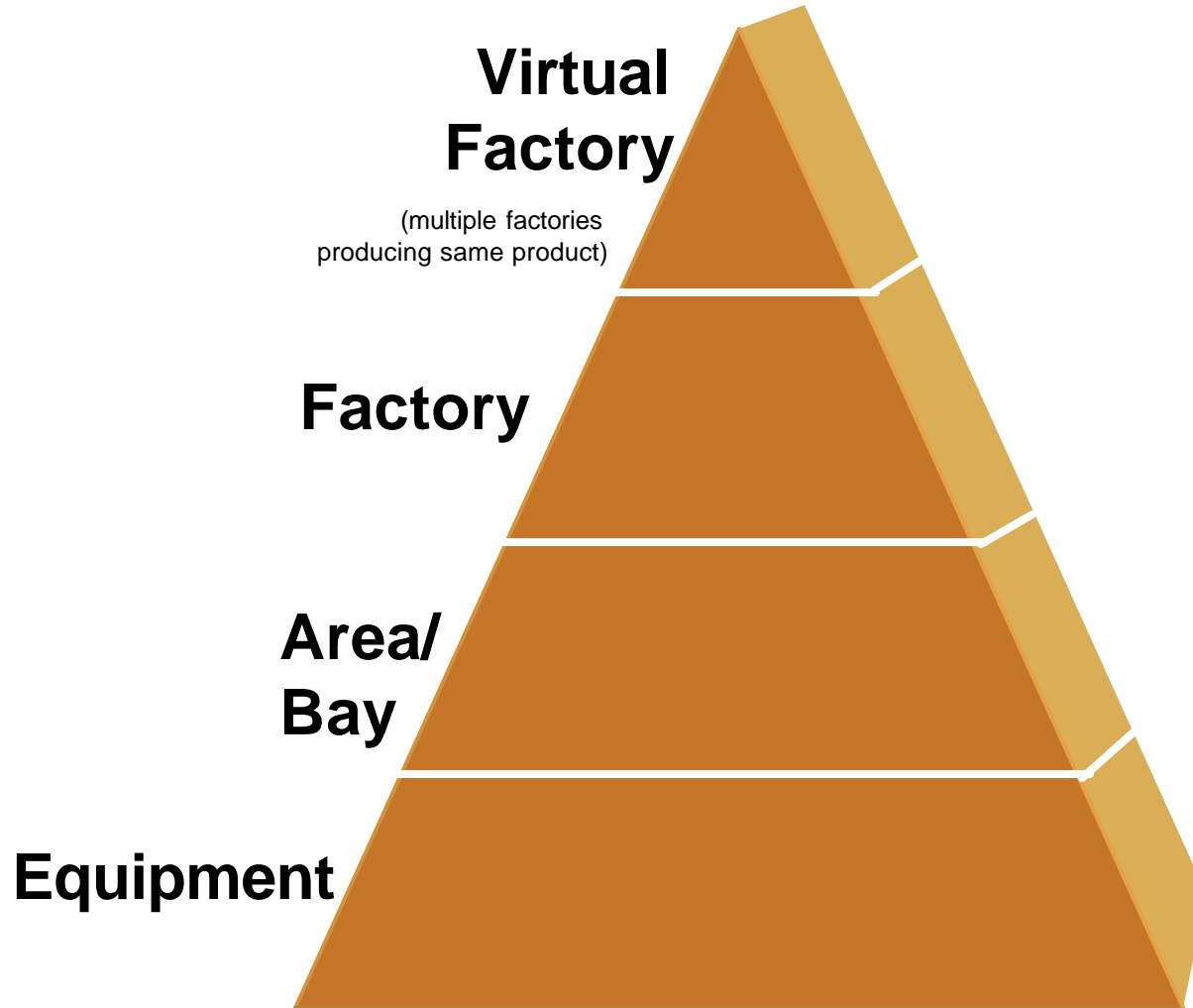


- Planning and coordination for integrated up-front factory designs by optimizing the interactions between the 4 elements

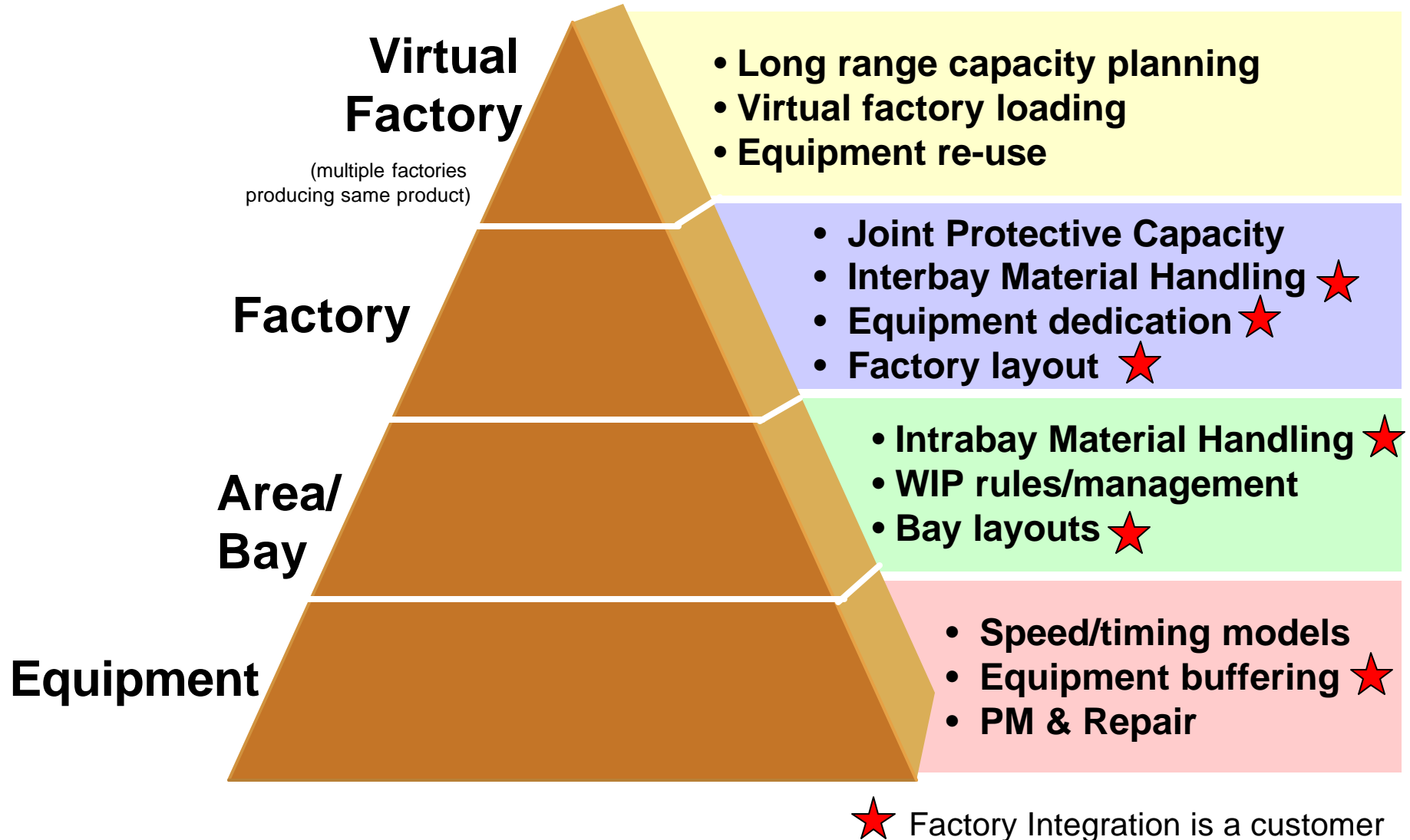
Decisions in Factory Integration

- Mainly concerned with decisions involving interfaces.
- A decision in one domain can have significant impact on the success of other domains.
- How to ensure decisions are made cross-functionally?
- What non-proprietary Standards must be pursued?
- Simulation results must support proactive Factory Integration decision making.

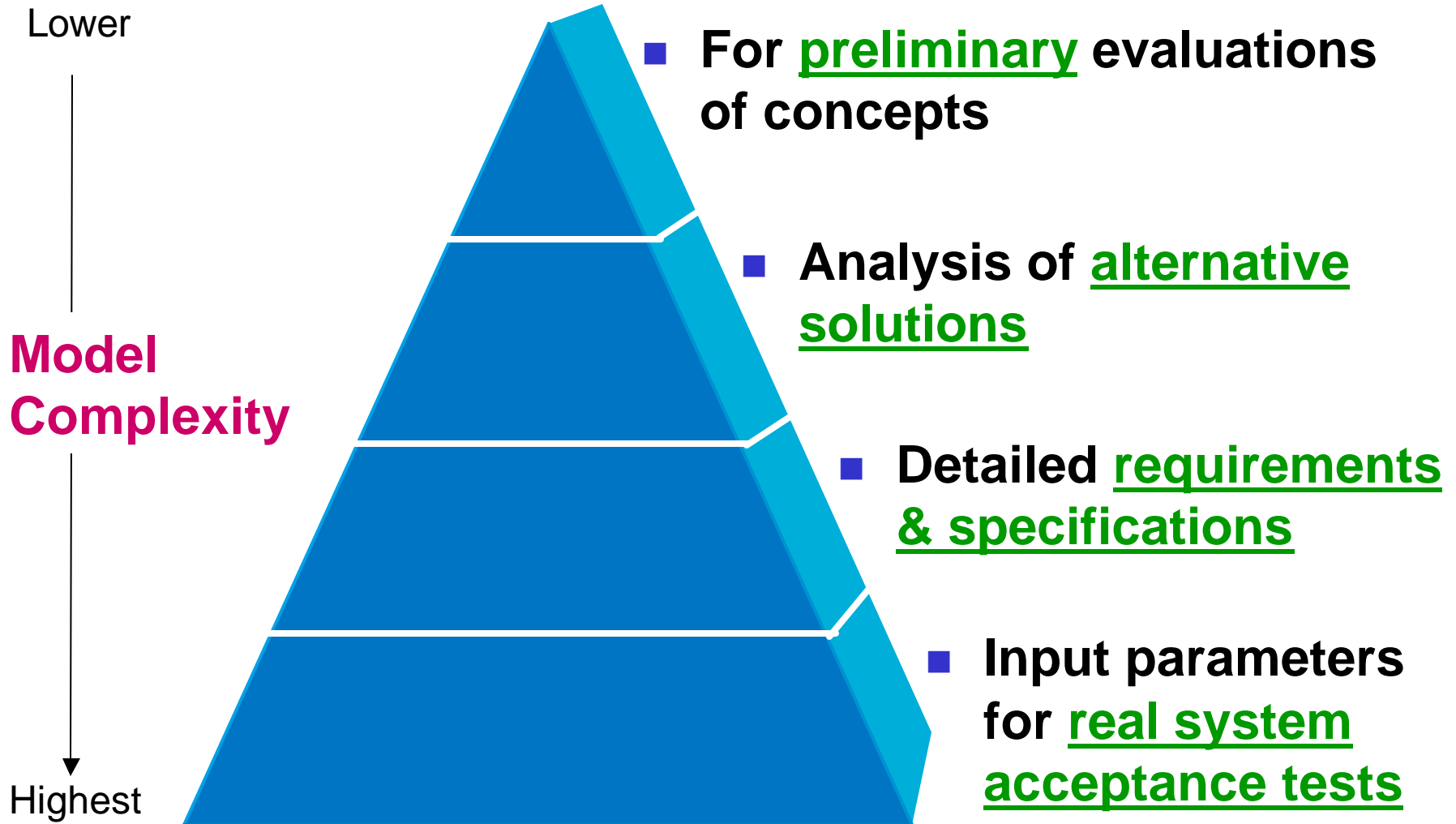
Modeling Space



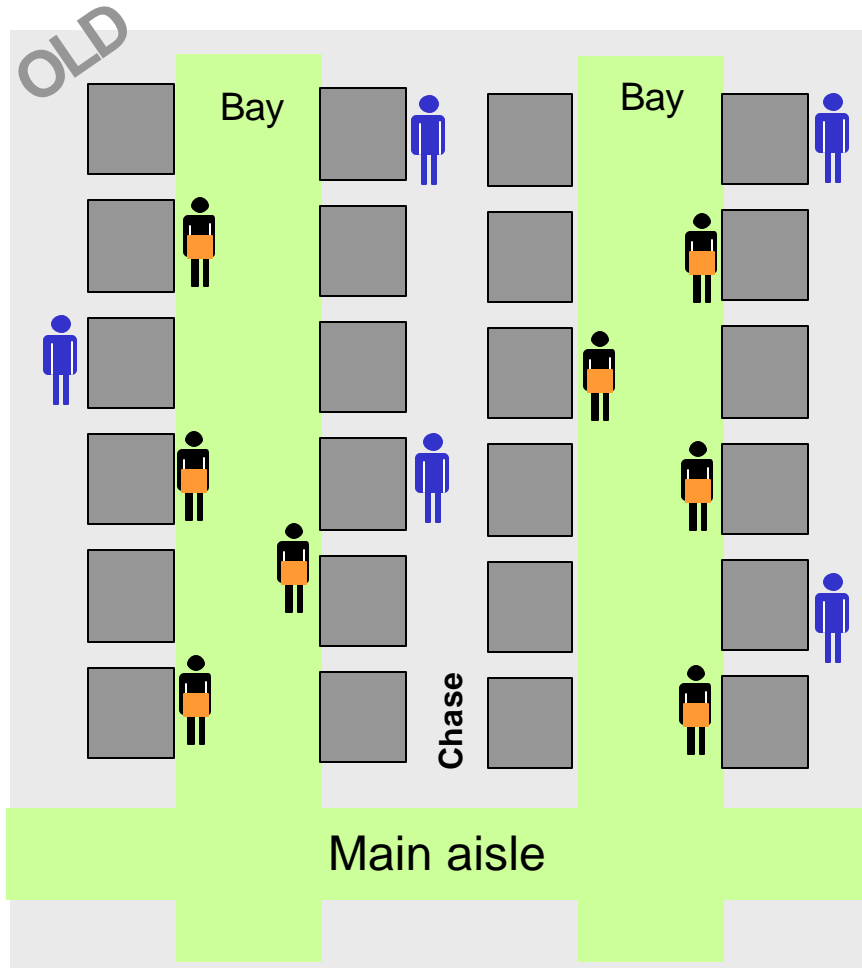
Modeling Space



Where models are used

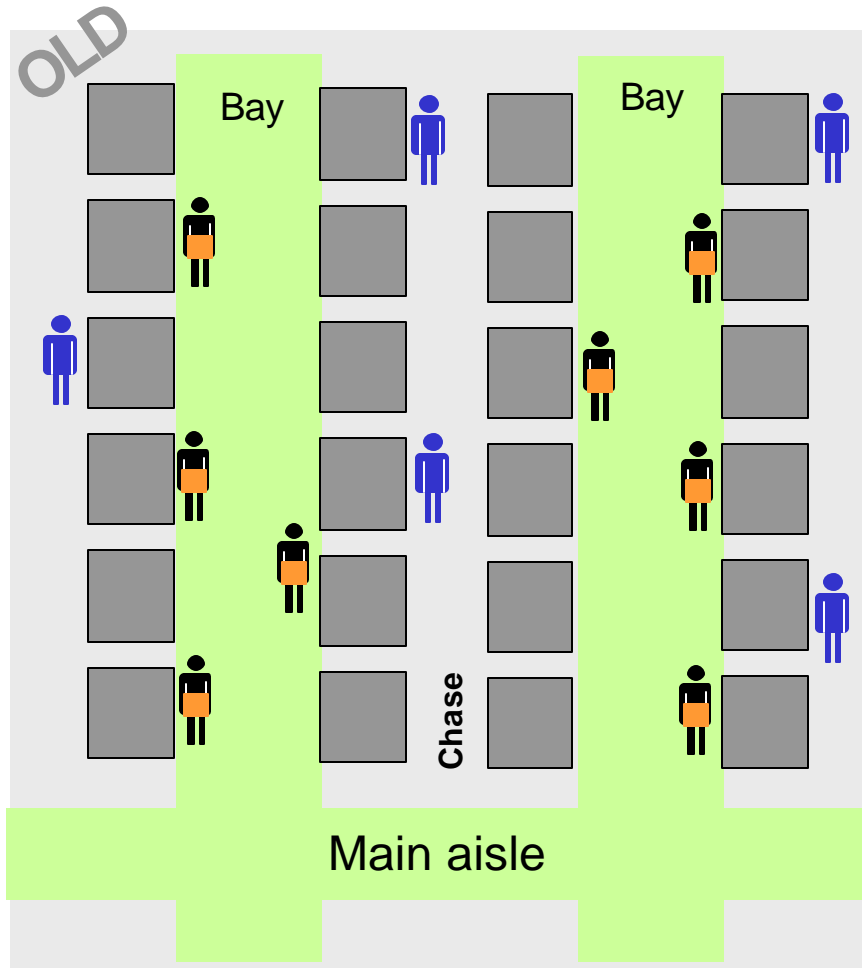


Factory Layouts are changing

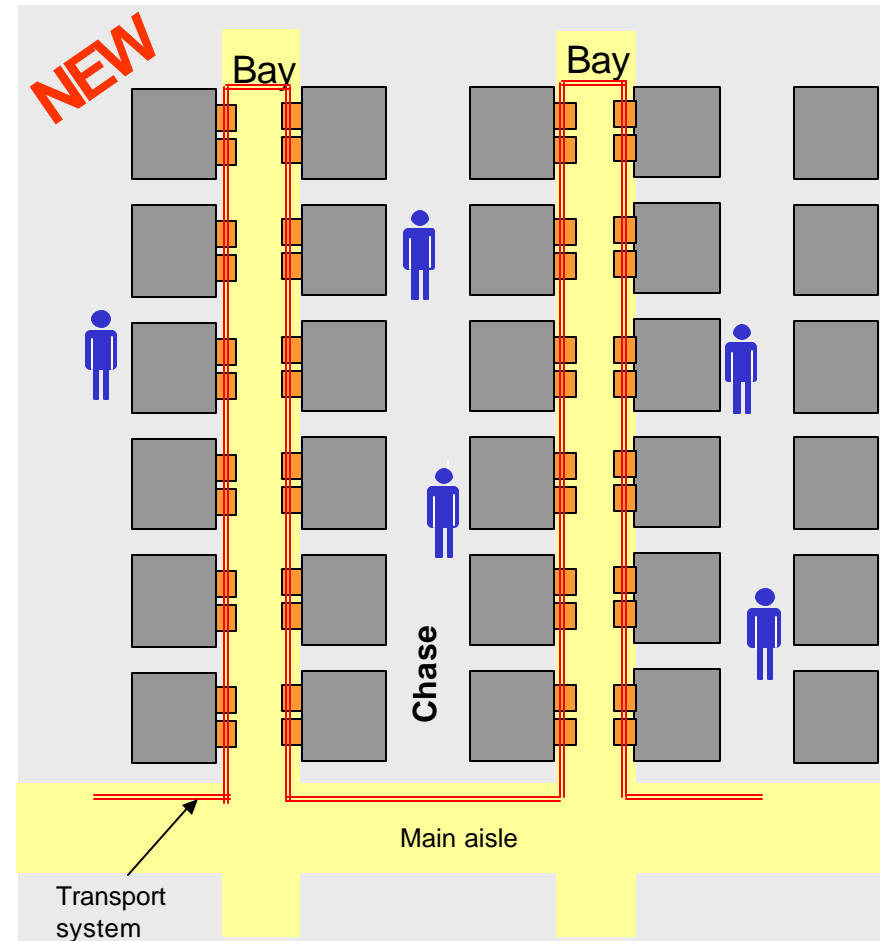


Layout for Manual WIP movement

Factory Layouts are changing



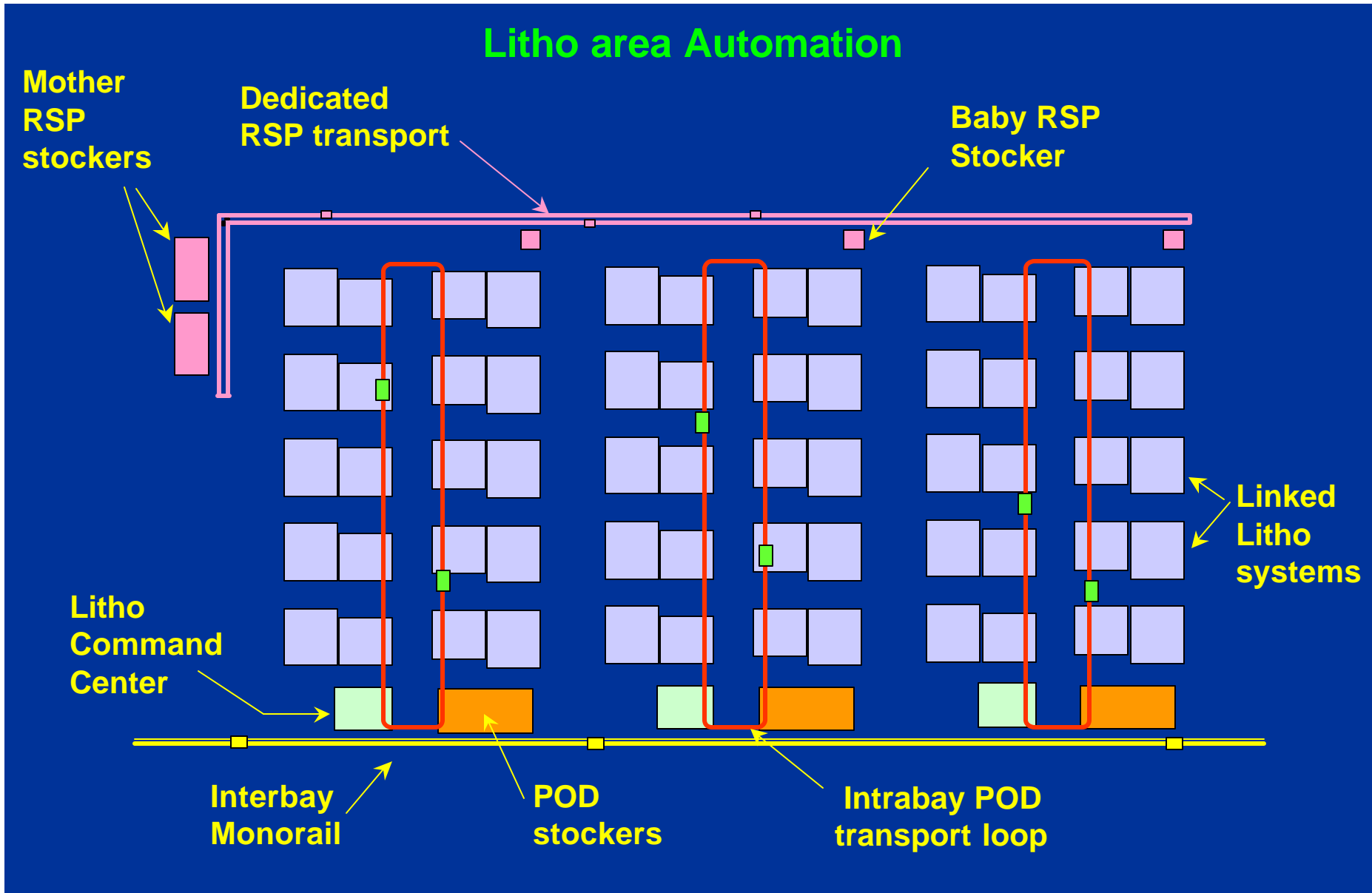
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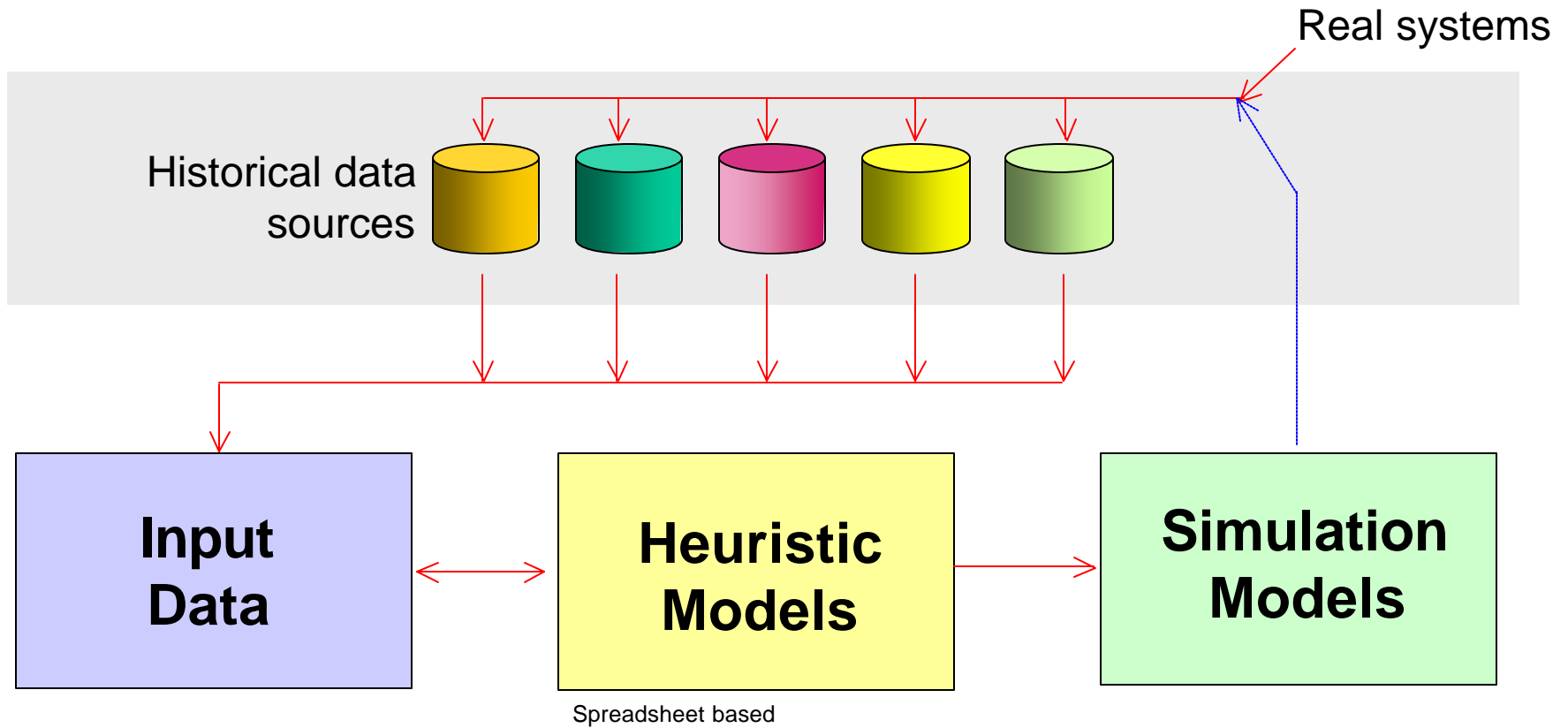
Layout for Maintenance Efficiency

Equipment Clustering meaning becomes very different!

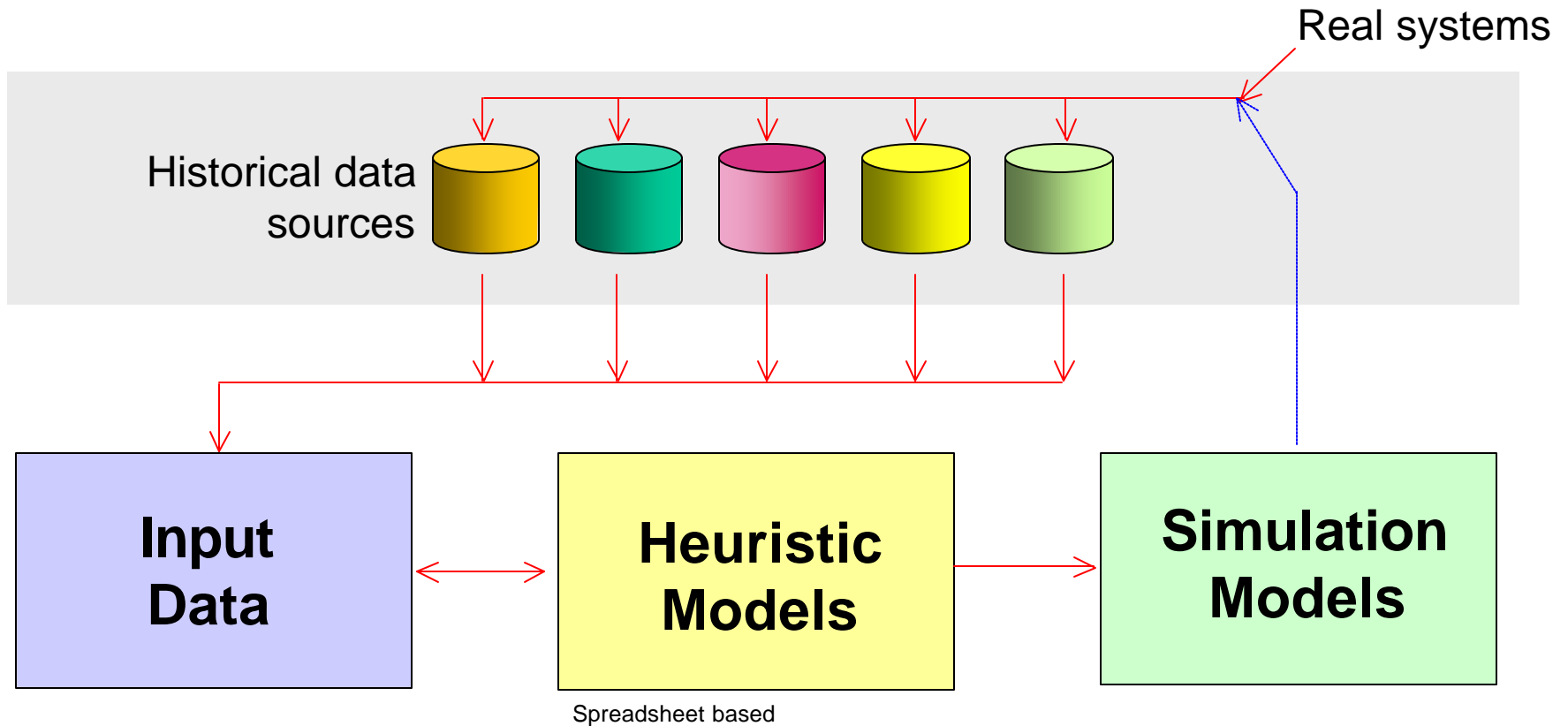
Automation compatible layouts



Model Types

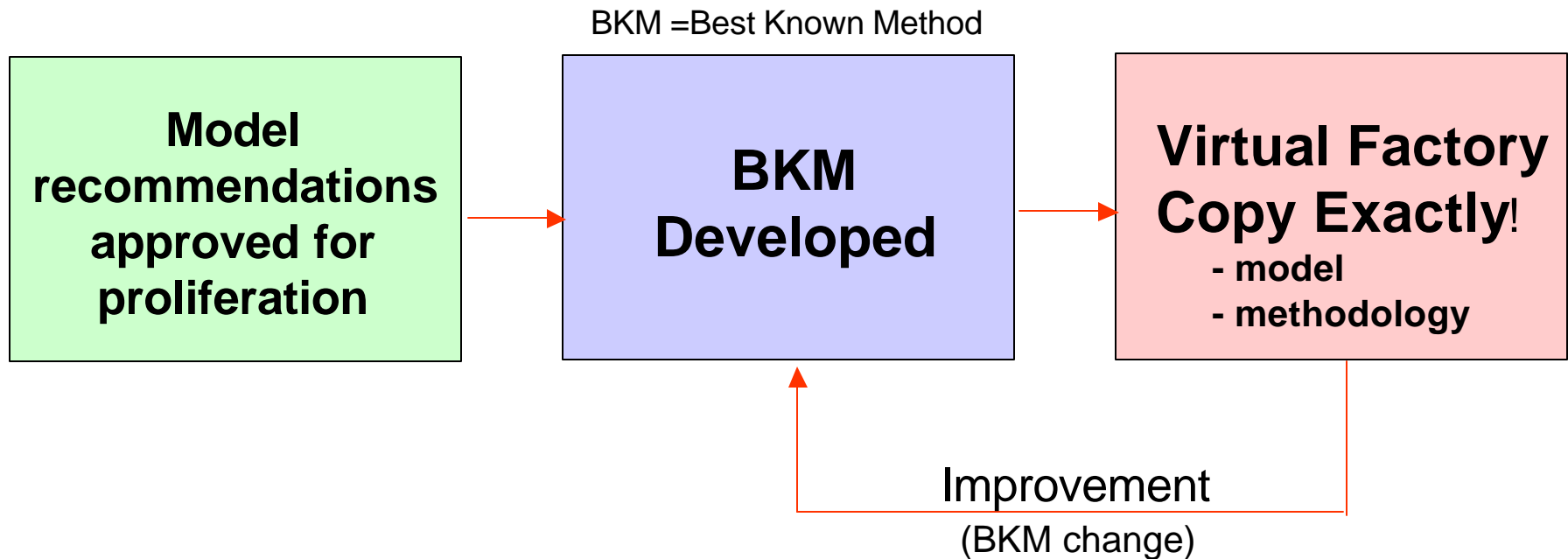


Model Types



Typical accuracy	➡	70-80%	80-90+%
Likelihood of factory transfer/usage	➡	Very high	Lower

Model Copy Exactly!



What's working with Simulation

- **It is addressing many difficult questions arising from highly integrated factories**
 - ◆ Bay layouts driven by intrabay transport (delivery) times
 - ◆ Worldwide agreement on equipment buffering
 - ◆ Increased use of ROI and other metrics
- **Has created teams of cross-functional experts working together to solve complex problems**
 - ◆ Customers become model stakeholders
 - ◆ Joint teams co-develop problem statements
 - ◆ Go after immediate opportunities first - then build on it
 - ◆ Gradual consensus building on viable solution sets
 - ◆ Better customer acceptance of recommendations

What needs Improvement

- **“Simulation people” have difficulty communicating his/her views and results to manufacturing customers:**
 - ◆ need to speak the same language as manufacturing
 - ◆ need to articulate why a result looks the way it is
 - ◆ need to convince the customer
 - ◆ are victims of NIH-“Who are you to tell me it should be changed?”
- **Model maintenance/support is often an “after-thought”**
 - ◆ seriously impacts modeling success and resources needed
 - ◆ not a modeler’s priority
- **Modeling cycle time is unable to keep up with business changes**
 - ◆ cycle time is too long - biggest complaint from customer/users
 - ◆ paradigm changes are needed in this area

Modeling dilemma -

Output Quality versus Timeliness

Modeler's Complaints

- Don't have enough data
- Worried by Quality of Output (results)
- Need more time to perform additional runs

Customer Expectation

- Timeliness of output is paramount due to rapid changes in factory
- Need reasonable results in a very short time

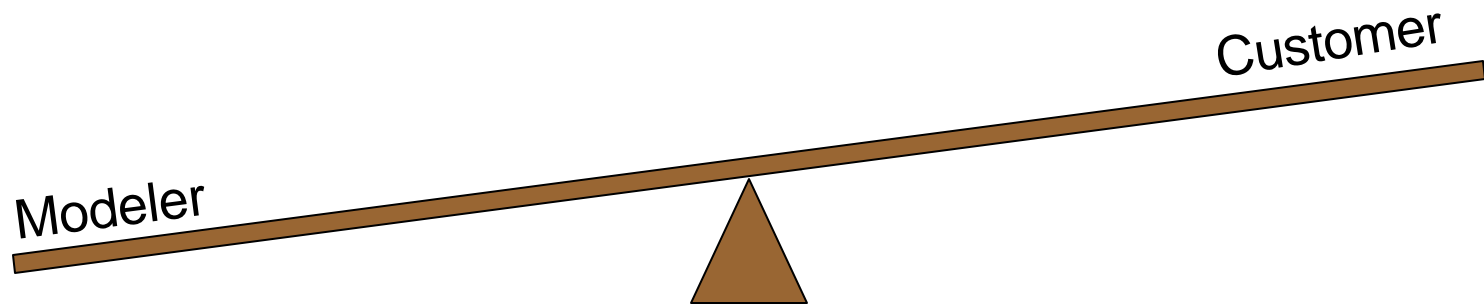
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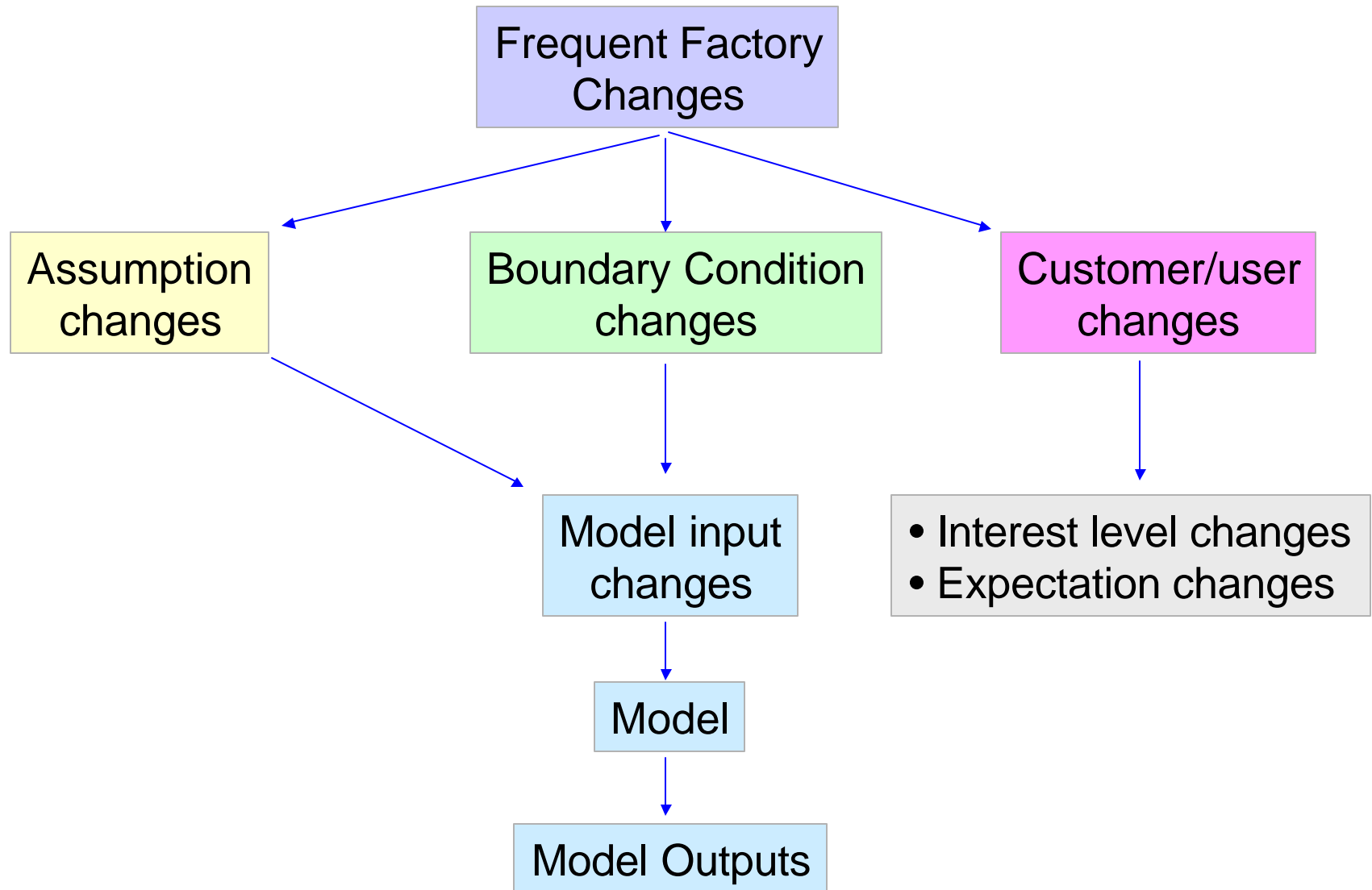
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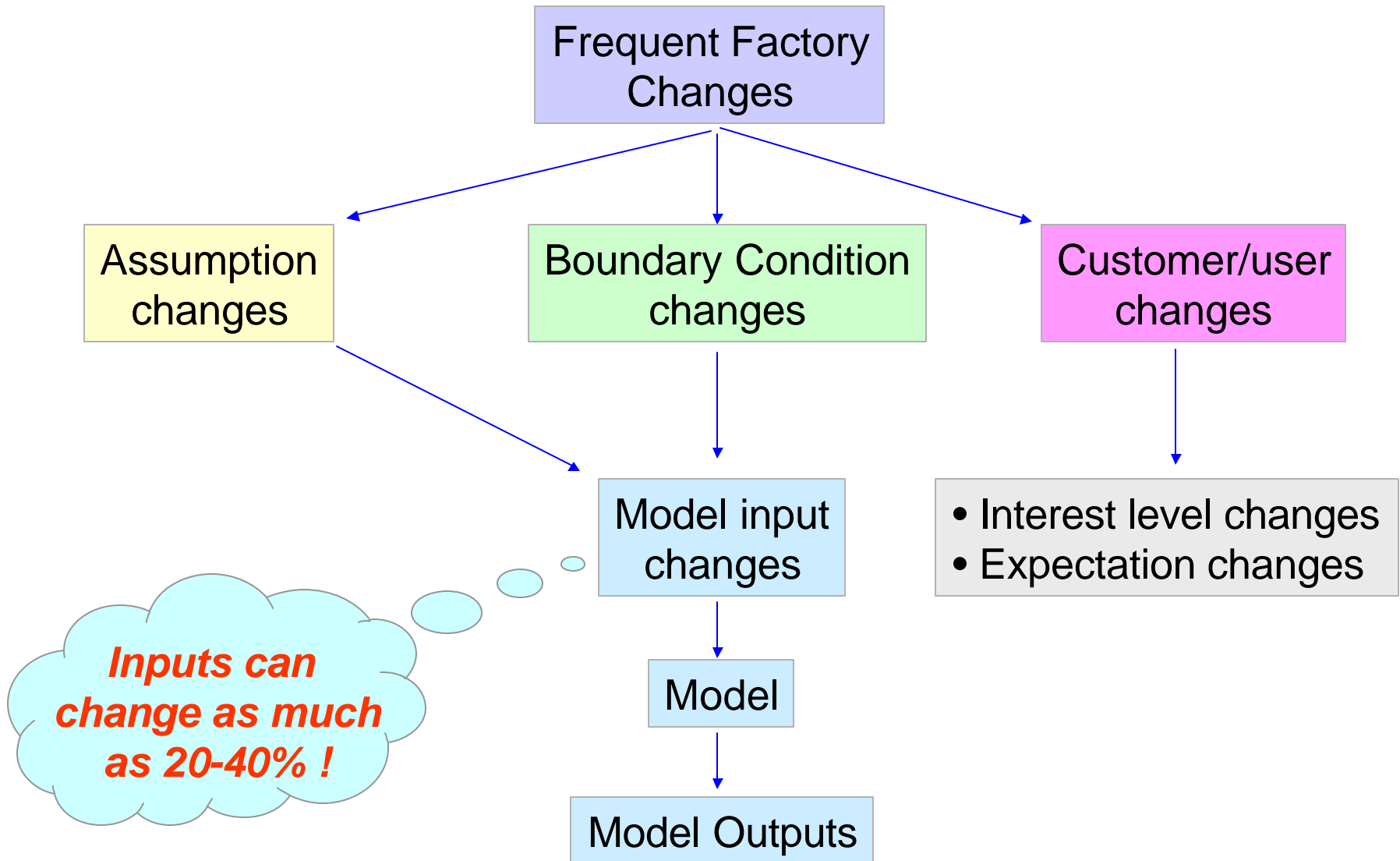


Current situation: Simulation cycle time is far too excessive

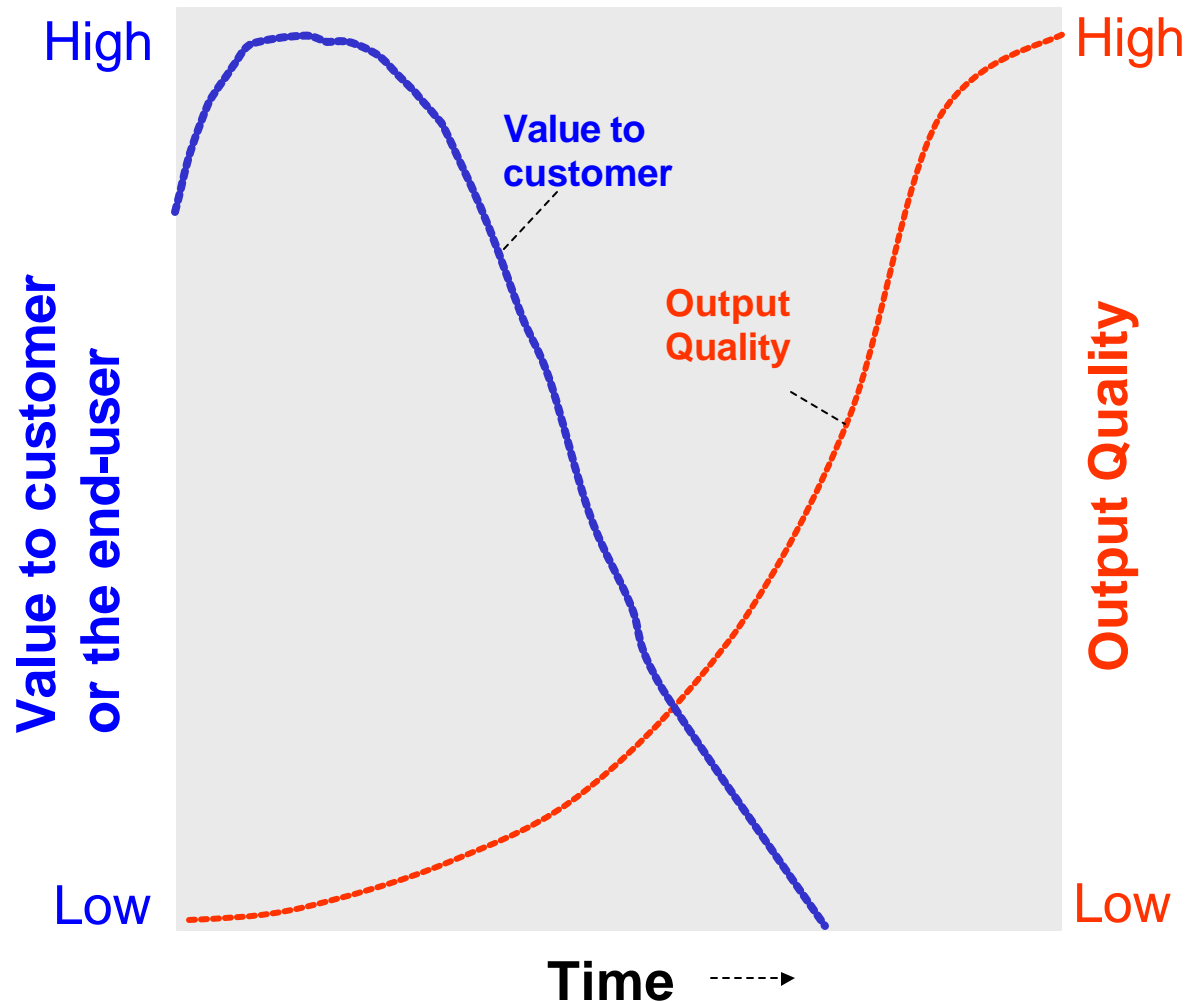
Timeliness of Model Outputs



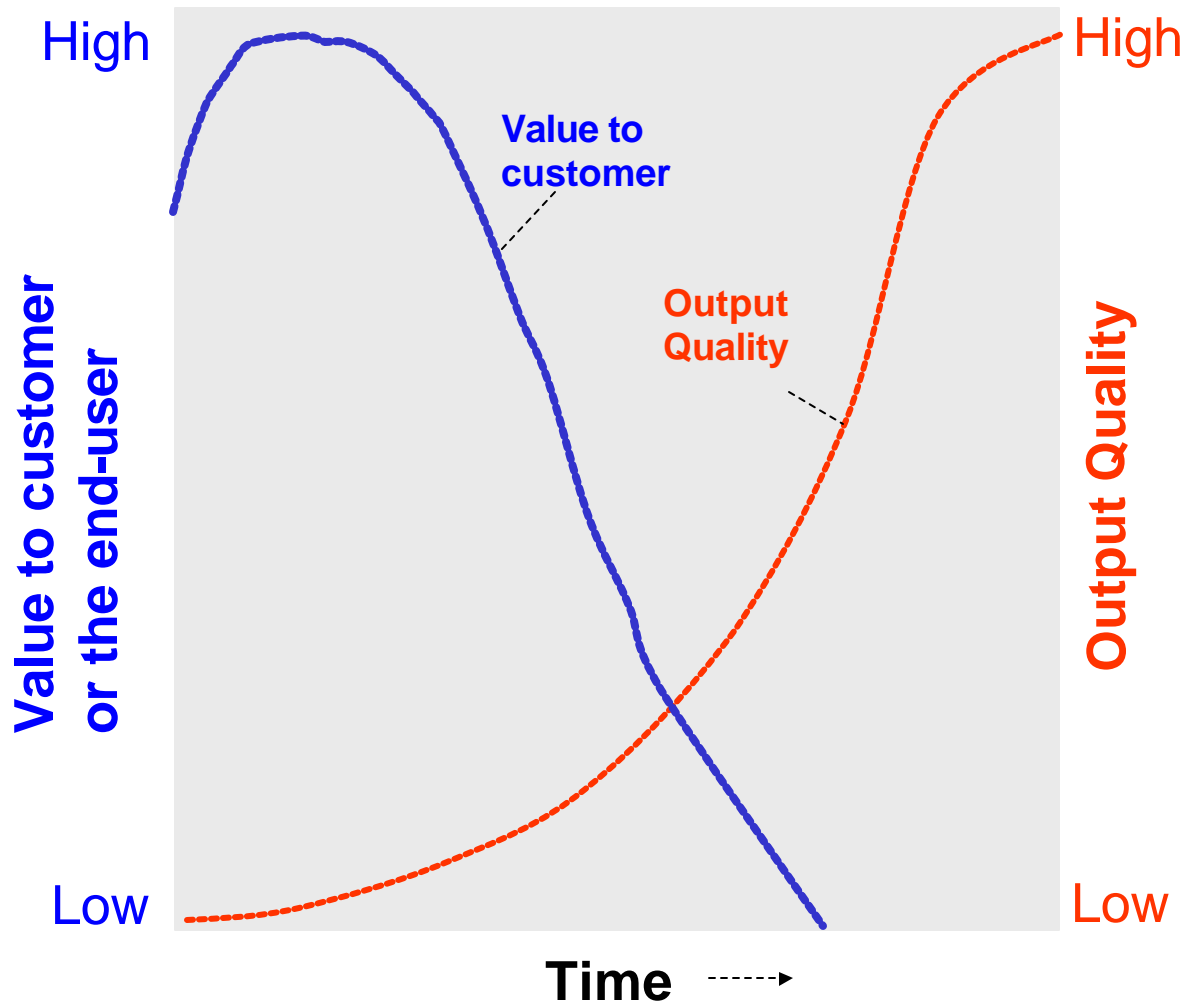
Timeliness of Model Outputs



Improvement required - Simulation takes too long to produce results

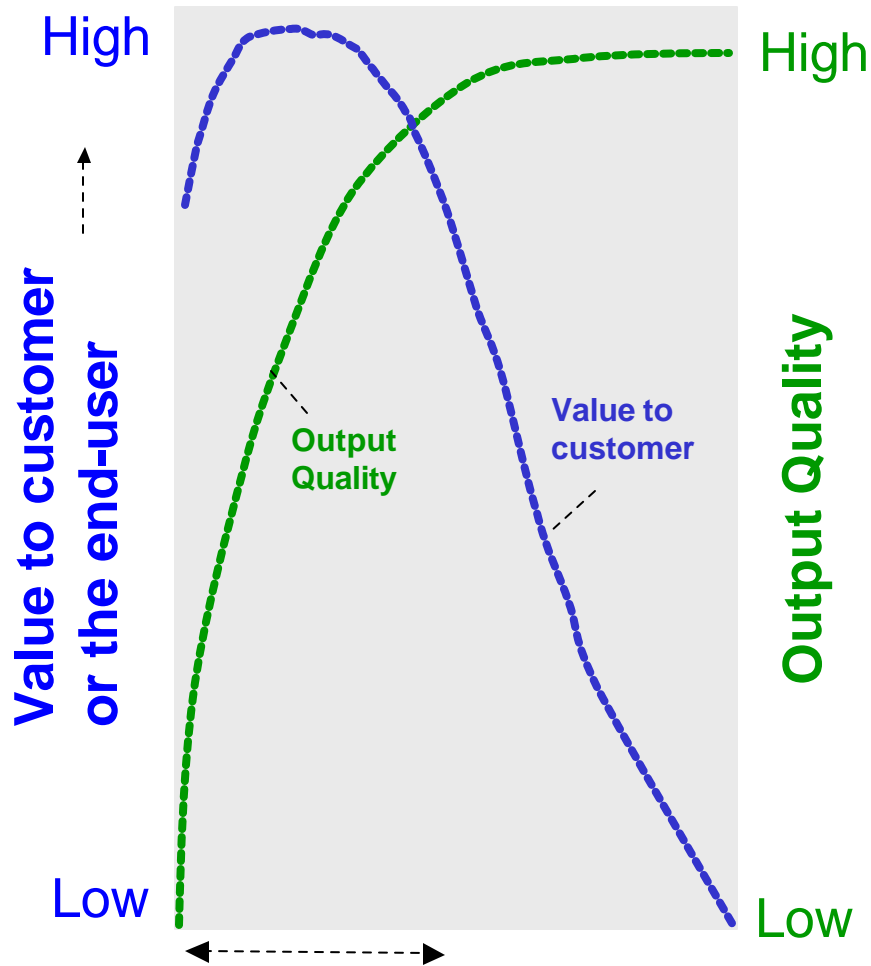


Improvement required - Simulation takes too long to produce results



- Simulation does not give credible answers in the time-frame the customer wants it.
- Customer loses interest using it to solve the problem.
- Simulation gets a bad name.
- Modeler frustrated with waning interest.

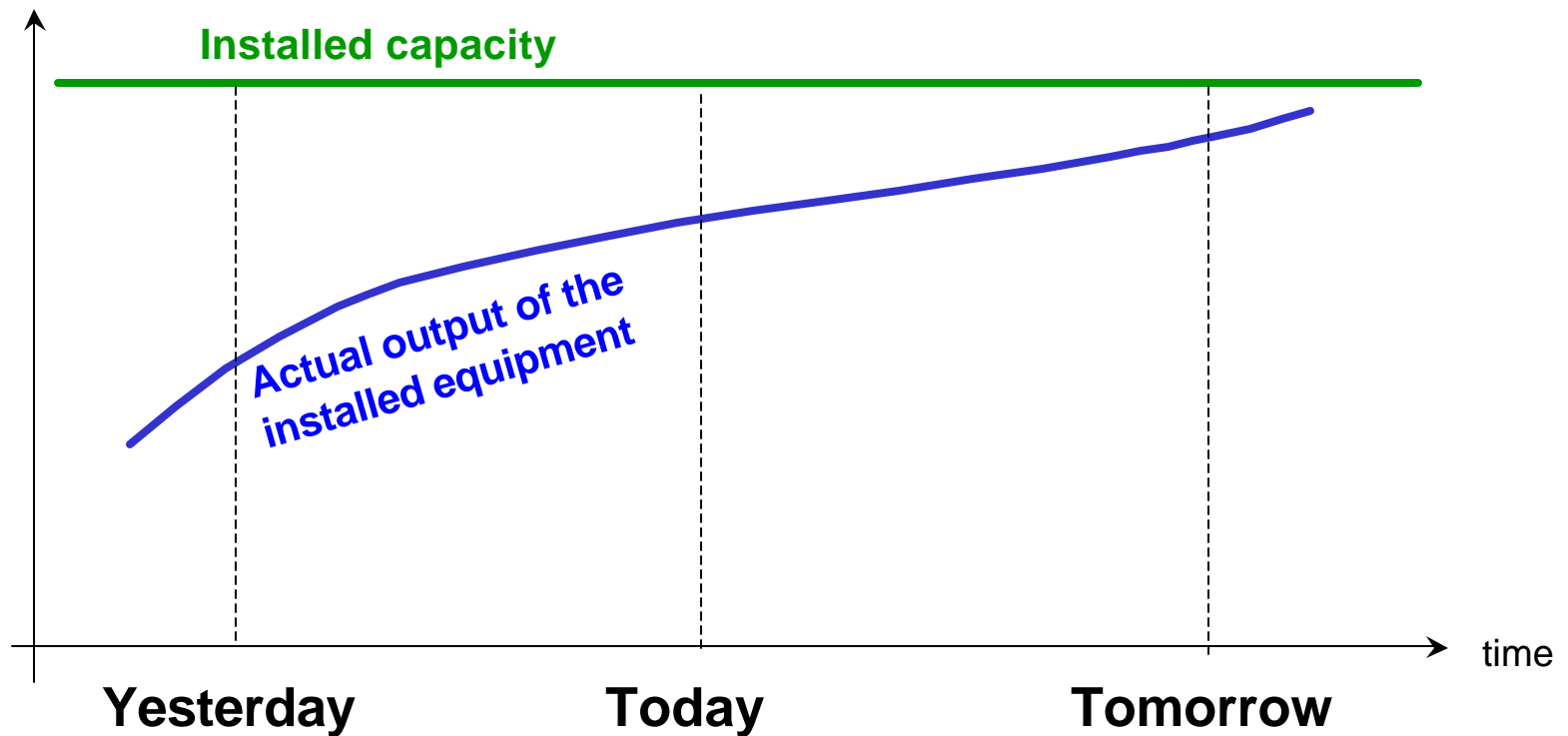
Paradigm change needed



“Operate in Internet Time”

- Reduce the cycle time for simulation to provide answers.
- Simulation must provide reasonable results in the time-frame a customer has interest in its outcome.
- Otherwise, decisions will continue to be made without simulation inputs.

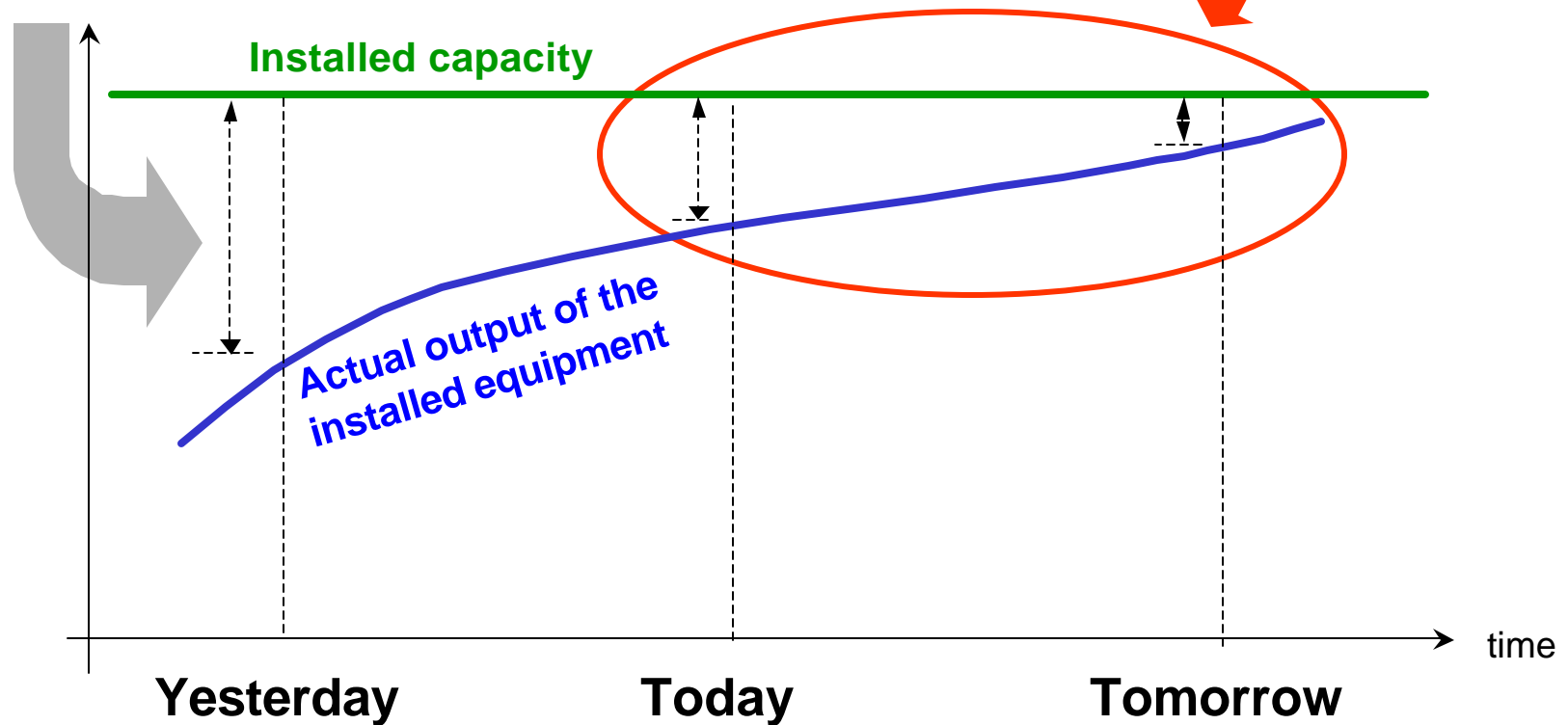
... yet valid models are mandatory



... yet valid models are mandatory

You may get away having an invalid model here!

But you cannot afford to be wrong in these times



Conclusion

- **It is getting more and more difficult to solve factory integration problems without good models**
 - ◆ integration problems are tougher to resolve
 - ◆ demand for good simulation analysts
- **In our competitive landscape, modeling capabilities must keep up with customer requirements**
 - ◆ modeling cycle time must improve significantly
 - ◆ invalid models can have catastrophic impacts on our profitability
- **Building modeling expertise in an organization requires sustained management commitment**
 - ◆ challenging career paths for modelers must be considered